

UNIT TERMINAL OBJECTIVE

6-1.1 At the completion of this unit, the paramedic student will be able to integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for a neonatal patient.

COGNITIVE OBJECTIVES

At the completion of this unit, the paramedic student will be able to:

- 6-1.2 Define the term newborn.(C-1)
- 6-1.3 Define the term neonate. (C-1)
- 6-1.4 Identify important antepartum factors that can affect childbirth. (C-1)
- 6-1.5 Identify important intrapartum factors that can term the newborn high risk. (C-1)
- 6-1.6 Identify the factors that lead to premature birth and low birth weight newborns. (C-1)
- 6-1.7 Distinguish between primary and secondary apnea. (C-3)
- 6-1.8 Discuss pulmonary perfusion and asphyxia. (C-1)
- 6-1.9 Identify the primary signs utilized for evaluating a newborn during resuscitation. (C-1)
- 6-1.10 Formulate an appropriate treatment plan for providing initial care to a newborn. (C-3)
- 6-1.11 Identify the appropriate use of the APGAR score in caring for a newborn.(C-1)
- 6-1.12 Calculate the APGAR score given various newborn situations. (C-3)
- 6-1.13 Determine when ventilatory assistance is appropriate for a newborn. (C-1)
- 6-1.14 Prepare appropriate ventilation equipment, adjuncts and technique for a newborn. (C-1)
- 6-1.15 Determine when chest compressions are appropriate for a newborn. (C-1)
- 6-1.16 Discuss appropriate chest compression techniques for a newborn. (C-1)
- 6-1.17 Assess patient improvement due to chest compressions and ventilations. (C-1)
- 6-1.18 Determine when endotracheal intubation is appropriate for a newborn. (C-1)
- 6-1.19 Discuss appropriate endotracheal intubation techniques for a newborn. (C-1)
- 6-1.20 Assess patient improvement due to endotracheal intubation. (C-1)
- 6-1.21 Identify complications related to endotracheal intubation for a newborn. (C-1)
- 6-1.22 Determine when vascular access is indicated for a newborn. (C-1)
- 6-1.23 Discuss the routes of medication administration for a newborn. (C-1)
- 6-1.24 Determine when blow-by oxygen delivery is appropriate for a newborn. (C-1)
- 6-1.25 Discuss appropriate blow-by oxygen delivery devices and technique for a newborn. (C-1)
- 6-1.26 Assess patient improvement due to assisted ventilations. (C-1)
- 6-1.27 Determine when an orogastric tube should be inserted during positive-pressure ventilation. (C-1)
- 6-1.28 Discuss the signs of hypovolemia in a newborn. (C-1)
- 6-1.29 Discuss the initial steps in resuscitation of a newborn. (C-1)
- 6-1.30 Assess patient improvement due to blow-by oxygen delivery. (C-1)
- 6-1.31 Discuss the effects maternal narcotic usage has on the newborn. (C-1)
- 6-1.32 Determine the appropriate treatment for the newborn with narcotic depression. (C-1)
- 6-1.33 Discuss appropriate transport guidelines for a newborn. (C-1)
- 6-1.34 Determine appropriate receiving facilities for low and high risk newborns. (C-1)
- 6-1.35 Describe the epidemiology, including the incidence, morbidity/ mortality, risk factors and prevention strategies for meconium aspiration. (C-1)
- 6-1.36 Discuss the pathophysiology of meconium aspiration. (C-1)
- 6-1.37 Discuss the assessment findings associated with meconium aspiration. (C-1)
- 6-1.38 Discuss the management/ treatment plan for meconium aspiration. (C-1)
- 6-1.39 Describe the epidemiology, including the incidence, morbidity/ mortality, risk factors and prevention strategies for apnea in the neonate. (C-1)
- 6-1.40 Discuss the pathophysiology of apnea in the neonate. (C-1)

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- 6-1.41 Discuss the assessment findings associated with apnea in the neonate. (C-1)
 - 6-1.42 Discuss the management/ treatment plan for apnea in the neonate. (C-1)
 - 6-1.43 Describe the epidemiology, pathophysiology, assessment findings, management/ treatment plan for diaphragmatic hernia. (C-1)
 - 6-1.44 Describe the epidemiology, including the incidence, morbidity/ mortality and risk factors for bradycardia in the neonate. (C-1)
 - 6-1.45 Discuss the pathophysiology of bradycardia in the neonate. (C-1)
 - 6-1.46 Discuss the assessment findings associated with bradycardia in the neonate. (C-1)
 - 6-1.47 Discuss the management/ treatment plan for bradycardia in the neonate. (C-1)
 - 6-1.48 Describe the epidemiology, including the incidence, morbidity/ mortality and risk factors for premature infants
 - 6-1.49 Discuss the pathophysiology of premature infants. (C-1)
 - 6-1.50 Discuss the assessment findings associated with premature infants. (C-1)
 - 6-1.51 Discuss the management/ treatment plan for premature infants. (C-1)
 - 6-1.52 Describe the epidemiology, including the incidence, morbidity/ mortality and risk factors for respiratory distress/ cyanosis in the neonate. (C-1)
 - 6-1.53 Discuss the pathophysiology of respiratory distress/ cyanosis in the neonate. (C-1)
 - 6-1.54 Discuss the assessment findings associated with respiratory distress/ cyanosis in the neonate. (C-1)
 - 6-1.55 Discuss the management/ treatment plan for respiratory distress/ cyanosis in the neonate.(C-1)
 - 6-1.56 Describe the epidemiology, including the incidence, morbidity/ mortality and risk factors for seizures in the neonate. (C-1)
 - 6-1.57 Discuss the pathophysiology of seizures in the neonate. (C-1)
 - 6-1.58 Discuss the assessment findings associated with seizures in the neonate. (C-1)
 - 6-1.59 Discuss the management/ treatment plan for seizures in the neonate. (C-1)
 - 6-1.60 Describe the epidemiology, including the incidence, morbidity/ mortality and risk factors for fever in the neonate. (C-1)
 - 6-1.61 Discuss the pathophysiology of fever in the neonate. (C-1)
 - 6-1.62 Discuss the assessment findings associated with fever in the neonate. (C-1)
 - 6-1.63 Discuss the management/ treatment plan for fever in the neonate. (C-1)
 - 6-1.64 Describe the epidemiology, including the incidence, morbidity/ mortality and risk factors for hypothermia in the neonate. (C-1)
 - 6-1.65 Discuss the pathophysiology of hypothermia in the neonate. (C-1)
 - 6-1.66 Discuss the assessment findings associated with hypothermia in the neonate. (C-1)
 - 6-1.67 Discuss the management/ treatment plan for hypothermia in the neonate. (C-1)
 - 6-1.68 Describe the epidemiology, including the incidence, morbidity/ mortality and risk factors for hypoglycemia in the neonate. (C-1)
 - 6-1.69 Discuss the pathophysiology of hypoglycemia in the neonate. (C-1)
 - 6-1.70 Discuss the assessment findings associated with hypoglycemia in the neonate. (C-1)
 - 6-1.71 Discuss the management/ treatment plan for hypoglycemia in the neonate. (C-1)
 - 6-1.72 Describe the epidemiology, including the incidence, morbidity/ mortality and risk factors for vomiting in the neonate (C-1)
 - 6-1.73 Discuss the pathophysiology of vomiting in the neonate. (C-1)
 - 6-1.74 Discuss the assessment findings associated with vomiting in the neonate. (C-1)
 - 6-1.75 Discuss the management/ treatment plan for vomiting in the neonate. (C-1)
 - 6-1.76 Describe the epidemiology, including the incidence, morbidity/ mortality and risk factors for diarrhea in the neonate. (C-1)
 - 6-1.77 Discuss the pathophysiology of in diarrhea the neonate. (C-1)
 - 6-1.78 Discuss the assessment findings associated with diarrhea in the neonate. (C-1)

- 6-1.79 Discuss the management/ treatment plan for diarrhea in the neonate. (C-1)
- 6-1.80 Describe the epidemiology, including the incidence, morbidity/ mortality and risk factors for common birth injuries in the neonate. (C-1)
- 6-1.81 Discuss the pathophysiology of common birth injuries in the neonate. (C-1)
- 6-1.82 Discuss the assessment findings associated with common birth injuries in the neonate. (C-1)
- 6-1.83 Discuss the management/ treatment plan for common birth injuries in the neonate. (C-1)
- 6-1.84 Describe the epidemiology, including the incidence, morbidity/ mortality and risk factors for cardiac arrest in the neonate. (C-1)
- 6-1.85 Discuss the pathophysiology of cardiac arrest in the neonate. (C-1)
- 6-1.86 Discuss the assessment findings associated with cardiac arrest in the neonate. (C-1)
- 6-1.87 Discuss the management/ treatment plan for cardiac arrest in the neonate. (C-1)
- 6-1.88 Discuss the pathophysiology of post arrest management of the neonate. (C-1)
- 6-1.89 Discuss the assessment findings associated with post arrest situations in the neonate. (C-1)
- 6-1.90 Discuss the management/ treatment plan to stabilize the post arrest neonate. (C-1)

AFFECTIVE OBJECTIVES

At the completion of this unit, the paramedic student will be able to:

- 6-1.91 Demonstrate and advocate appropriate interaction with a newborn/ neonate that conveys respect for their position in life. (A-3)
- 6-1.92 Recognize the emotional impact of newborn/ neonate injuries/ illnesses on parents/ guardians. (A-1)
- 6-1.93 Recognize and appreciate the physical and emotional difficulties associated with separation of the parent/ guardian and a newborn/ neonate. (A-3)
- 6-1.94 Listen to the concerns expressed by parents/ guardians. (A-1)
- 6-1.95 Attend to the need for reassurance, empathy and compassion for the parent/ guardian. (A-1)

PSYCHOMOTOR OBJECTIVES

At the completion of this unit, the paramedic student will be able to:

- 6-1.96 Demonstrate preparation of a newborn resuscitation area. (P-2)
- 6-1.97 Demonstrate appropriate assessment technique for examining a newborn. (P-2)
- 6-1.98 Demonstrate appropriate assisted ventilations for a newborn. (P-2)
- 6-1.99 Demonstrate appropriate endotracheal intubation technique for a newborn. (P-2)
- 6-1.100 Demonstrate appropriate meconium aspiration suctioning technique for a newborn. (P-2)
- 6-1.101 Demonstrate appropriate insertion of an orogastric tube. (P-2)
- 6-1.102 Demonstrate needle chest decompression for a newborn or neonate. (P-2)
- 6-1.103 Demonstrate appropriate chest compression and ventilation technique for a newborn. (P-2)
- 6-1.104 Demonstrate appropriate techniques to improve or eliminate endotracheal intubation complications. (P-2)
- 6-1.105 Demonstrate vascular access cannulation techniques for a newborn. (P-2)
- 6-1.106 Demonstrate the initial steps in resuscitation of a newborn. (P-2)
- 6-1.107 Demonstrate blow-by oxygen delivery for a newborn. (P-2)

DECLARATIVE

- I. Introduction
 - A. Newborn
 1. A recently born infant; usually considered the first few hours of life
 - B. Neonate
 1. Considered the first 28 days of life

- II. General pathophysiology, assessment and management
 - A. Epidemiology
 1. Incidence
 - a. Approximately 6% of deliveries require life support
 - b. Incidence of complications increases as birth weight decreases
 2. Morbidity/ mortality
 - a. Neonatal mortality risk can be determined via graphs based on birth weight and gestational age
 - b. Resuscitation is required for about 80% of the 30,000 babies who weigh less than 1500 grams at birth
 3. Risk factors
 - a. Antepartum factors
 - (1) Multiple gestation
 - (2) Inadequate prenatal care
 - (3) Mother's age <16 or >35
 - (4) History of perinatal morbidity or mortality
 - (5) Post-term gestation
 - (6) Drugs/ medications
 - (7) Toxemia, hypertension, diabetes
 - b. Intrapartum factors
 - (1) Premature labor
 - (2) Meconium-stained amniotic fluid
 - (3) Rupture of membranes greater than 24 hours prior to delivery
 - (4) Use of narcotics within four hours of delivery
 - (5) Abnormal presentation
 - (6) Prolonged labor or precipitous delivery
 - (7) Prolapsed cord
 - (8) Bleeding
 4. Treatment strategies
 - a. Preparation of resuscitation equipment
 - b. Determine appropriate destination
 - B. Pathophysiology
 1. Transition from fetal to neonatal circulation
 2. Respiratory system must suddenly initiate and maintain oxygenation
 3. Infants are very sensitive to hypoxia
 4. Permanent brain damage will occur with hypoxemia
 5. Apnea in newborns
 6. Congenital anomalies
 - a. Diaphragmatic hernia
 - b. Choanal atresia

- c. Pierre Robin Syndrome
 - d. Cleft lip
 - e. Exposed abdominal contents
- C. Assessment
1. Time of delivery
 2. Normal/ abnormal vital signs
 3. Airway and ventilation
 - a. Respiratory rate
 - b. Respiratory effort
 4. Circulation
 - a. Heart rate
 - (1) Normal
 - b. Color/ cyanosis
 - (1) Normal
 - (2) Central versus peripheral
 - (3) Mucosal membranes
 - c. End organ perfusion
 - (1) Compare strength of central pulses versus peripheral
 - (2) Capillary refill
 5. APGAR
 - a. Appearance - skin color
 - (1) Completely pink - 2
 - (2) Body pink, extremities blue - 1
 - (3) Blue, pale - 0
 - b. Pulse rate
 - (1) Above 100 - 2
 - (2) Below 100 - 1
 - (3) Absent - 0
 - c. Grimace - irritability
 - (1) Cries - 2
 - (2) Grimaces - 1
 - (3) No response - 0
 - d. Activity - muscle tone
 - (1) Active motion - 2
 - (2) Some flexion of extremities - 1
 - (3) Limp - 0
 - e. Respiratory - effort
 - (1) Strong cry - 2
 - (2) Slow and irregular - 1
 - (3) Absent - 0
- D. Treatment
1. Prior to delivery, prepare environment and equipment
 2. During delivery, suction mouth and nose as head delivers
 3. After delivery
 - a. Airway and ventilation
 - (1) Drying
 - (a) Head and face
 - (b) Body

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- (2) Warming
 - (a) Appropriate techniques
 - (3) Position
 - (4) Suction
 - (a) Technique
 - i) Mouth first, than nares
 - ii) Nasal suctioning is a stimulus to breathe
 - (b) Equipment
 - i) Bulb suction
 - ii) Suction catheters
 - iii) Meconium aspirator
 - (5) Stimulation
 - (a) Flicking soles of feet
 - (b) Stroking back
 - (6) Blow-by oxygen
 - (a) Never withhold oxygen
 - (b) Oxygen should be warmed
 - (c) Use when
 - i) Newborn is cyanotic and
 - ii) Heart rate > 100 and
 - iii) Adequate respiratory rate and effort
 - (d) 5 liters/ minute maximum
 - i) Complications due to hypothermia
 - (e) Appropriate techniques
 - (7) Oral airways - rarely used for neonates
 - (a) Necessary to keep mouth open for ventilation
 - (b) Bilateral choanal atresia
 - (c) Pierre Robin Syndrome
 - (8) Bag-valve-mask
 - (a) Mask characteristics
 - i) Appropriate size
 - ii) Minimize dead-space
 - (b) Bag characteristics
 - i) Pop-off valve should be disabled
 - (c) Use when
 - i) Apneic
 - ii) Inadequate respiratory rate or effort
 - iii) Heart rate less than 100
 - (d) Technique
 - i) Initial ventilations require higher pressure to expand lungs
 - (9) Intubation
 - (a) Indications
 - i) Prolonged positive pressure ventilation
 - ii) Bag and mask ventilations ineffective
 - iii) Tracheal suctioning required
 - iv) Diaphragmatic hernia suspected
 - (b) Technique

- i) Equipment
 - a) Suction equipment
 - b) Laryngoscope
 - c) Blades-straight
 - #1- full term
 - #0- preterm
 - d) Endotracheal tubes
 - 2.5 to 4.0 mm ID
 - e) Shoulder roll
 - f) Adhesive tape
 - (c) Confirmation
 - i) Visualization
 - a) Tube passing through the cords
 - Vocal cord guide should stop at the level of the cords
 - b) Chest expansion with ventilation
 - ii) Auscultation
 - a) Laterally and high on the chest wall
 - b) Epigastric region
 - iii) Patient improvement
 - (d) PEEP
 - (10) Gastric decompression
 - (a) Abdominal distention is impeding ventilation
 - (b) Presence of diaphragmatic hernia
 - b. Circulation
 - (1) Vascular access
 - (a) Indications
 - i) To administer fluids
 - ii) To administer medications
 - (b) Peripheral vein cannulation
 - (c) Umbilical vein cannulation
 - (d) Intraosseous cannulation
 - (2) Chest compression (in addition to assisted ventilation with BVM)
 - (a) Indications
 - i) Heart rate less than 60
 - ii) Heart rate between 60 and 80 and not increasing with adequate oxygenation
 - (b) Technique
 - i) Two finger technique
 - ii) Thumb technique
 - (c) Rate
 - i) 120 per minute
 - (d) Depth
 - i) 1/2 - 3/4 inches
 - (e) Compression-to-ventilation ratio
 - i) 3 compressions to 1 ventilation
 - c. Pharmacological
 - (1) Bradycardia

- (2) Low blood volume
- (3) Respiration depression secondary to narcotics
- (4) Metabolic acidosis
- d. Non-pharmacological
 - (1) Temperature control
 - (2) Positioning
- e. Transport consideration
 - (1) Rapid transportation of the distressed infant
 - (2) Position newborn on their side to prevent aspiration
- f. Psychological support/ communication strategies
 - (1) Allow healthy newborn to bond with mother if possible

III. Specific situations

A. Meconium stained amniotic fluid

1. Epidemiology
 - a. Incidence
 - (1) Approximately 10 - 15% of deliveries
 - (2) May occur either in utero or intrapartum
 - (3) Mostly in post-term and small-for-gestational-age newborns
 - b. Morbidity/ mortality
 - (1) High mortality
 - (2) Hypoxemia
 - (3) Aspiration pneumonia
 - (4) Pneumothorax
 - (5) Pulmonary hypertension
 - c. Risk factors
 - (1) Fetal distress during labor and delivery
 - (2) Post-term infants
2. Anatomy and physiology review
3. Pathophysiology
 - a. Hypoxia or physiologic cause
 - b. Aspiration of meconium stained amniotic fluid
 - (1) Airway obstruction
 - (a) Complete
 - i) Atelectasis
 - ii) Right-to-left shunt across the foramen ovale
 - (b) Incomplete
 - i) Ball valve type obstruction
 - ii) Developing pneumothorax
 - c. Patient deterioration
 - (1) Hypoxia
 - (2) Hypercapnia
 - (3) Acidosis
4. Assessment findings
 - a. Thin and watery
 - b. Thick and particulate
 - (1) Dark green-black amniotic fluid
5. Management considerations for thick or particulate meconium

- a. Airway and ventilation
 - (1) Do not stimulate the infant to breathe
 - (2) Tracheal suction under direct visualization
 - (a) End point considerations
 - i) Airway is clear
 - ii) Infant breathes on own
 - iii) Bradycardia
 - (3) Ventilate with 100% oxygen
 - b. Circulation
 - (1) Assure adequate perfusion
 - c. Pharmacological
 - (1) If hypotensive, administer fluid challenge
 - d. Non-pharmacological
 - (1) Needle decompression may be required
 - (2) Hypothermia prevention
 - e. Transport consideration
 - (1) Identify facility to handle high-risk newborn
 - f. Psychological support/ communication strategies
 - (1) Do not discuss "chances of survival" with family
 - (2) Explain what is being done for the newborn
- B. Apnea in the neonate
- 1. Epidemiology
 - a. Incidence
 - (1) Common finding in preterm infants
 - b. Morbidity/ mortality
 - (1) If prolonged, can lead to hypoxemia and bradycardia
 - c. Risk factors
 - (1) Prematurity
 - (2) In newborn, prolonged or difficult labor and delivery
 - (3) Drug exposure
 - 2. Anatomy and physiology review
 - 3. Pathophysiology
 - a. Usually due to hypoxia or hypothermia
 - b. May be due to other causes
 - (1) Narcotics or central nervous system depressant
 - (2) Airway and respiratory muscle weakness
 - (3) Oxyhemoglobin dissociation curve shift
 - (4) Septicemia
 - (5) Metabolic disorder
 - (6) Central nervous system disorders
 - 4. Assessment findings
 - a. Failure to breathe spontaneously after stimulation
 - b. Respiratory pauses greater than 20 seconds
 - 5. Management considerations
 - a. Airway and ventilation
 - (1) Stimulate the baby to breathe
 - (a) Flicking the soles of the feet
 - (b) Rubbing the back

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- (2) Ventilate with BVM
 - (a) Disable pop-off valve
 - (b) Subsequent ventilations with minimal pressure to cause chest rise
 - (3) Suction as needed
 - (4) Intubation
 - (a) Indications
 - i) Heart rate less than 60 with adequate BVM ventilation and chest compressions
 - ii) Prolonged positive-pressure ventilations
 - iii) Prolonged apnea
 - iv) Central cyanosis despite adequate ventilations
 - (b) Complications
 - i) Tube dislodgement
 - ii) Tube occlusion by mucous or meconium
 - iii) Pneumothorax
 - b. Circulation
 - (1) Monitor heart rate continuously
 - (2) Circulatory access
 - (a) Umbilical vein cannulation in newborn
 - (b) Peripheral IV
 - (c) Intraosseous
 - c. Pharmacological
 - (1) Consider narcotic antagonists if narcotic administered within four hours of delivery
 - (2) NO narcotic antagonist should be utilized if mother is a drug abuser
 - (3) Consider dextrose (D10) administration if hypoglycemic
 - d. Non-pharmacological
 - (1) Hypothermia preventions
 - e. Transport consideration
 - (1) Identify facility to handle high-risk newborn
 - f. Psychological support/ communication strategies
 - (1) Relatively good outcome if treated early and aggressively
 - (2) Explain what is being done for the infant
 - C. Diaphragmatic hernia in the neonate
 - 1. Epidemiology
 - a. Incidence
 - (1) Occurs in 1 in 2200 live births
 - (2) Most commonly (90%) on the left side
 - b. Morbidity/ mortality
 - (1) Survival for infant who require mechanical ventilation in the first 18 to 24 hours of life is approximately 50%
 - (2) If no respiratory distress within the first 24 hours of life survival approaches 100%
 - c. Risk factors
 - (1) Bag and mask ventilation can worsen condition
 - 2. Anatomy and physiology review
 - 3. Pathophysiology

- a. Abdominal contents are displaced into the thorax
 - b. Heart may be displaced
 - 4. Assessment findings
 - a. Little to severe distress
 - b. May have cyanosis unresponsive to ventilations
 - c. Scaphoid (flat) abdomen
 - d. Bowel sounds heard in chest
 - e. Heart sounds displaced to right
 - 5. Management considerations
 - a. Airway and ventilation
 - (1) Assure adequate oxygen
 - (2) Place an orogastric tube and apply low, intermittent suction
 - (3) Endotracheal intubation may be necessary
 - b. Circulation
 - (1) Monitor heart rate continuously
 - c. Pharmacological
 - (1) None indicated for primary problem
 - d. Non-pharmacological
 - (1) Surgical repair required
 - e. Transport consideration
 - (1) Identify facility to handle high-risk newborn
 - f. Psychological support/ communication strategies
 - (1) Explain what is being done for the infant
- D. Bradycardia in the neonate
 - 1. Epidemiology
 - a. Incidence
 - (1) Most commonly caused by hypoxia
 - (2) Increased intracranial pressure
 - (3) Hypothyroidism
 - (4) Acidosis
 - b. Morbidity/ mortality
 - (1) Minimal risk if hypoxia is corrected quickly
 - c. Risk factors
 - (1) Treatment via pharmacological measures alone
 - (2) Prolonged suction or airway instrumentation
 - 2. Anatomy and physiology review
 - 3. Pathophysiology
 - 4. Assessment findings
 - a. Primarily caused by hypoxia
 - 4. Assessment findings
 - a. Assess upper airway for obstruction
 - (1) Secretions
 - (2) Tongue and soft tissue positioning
 - (3) Foreign body
 - b. Assess patient for hypoventilation
 - c. Palpate umbilical stump or brachial artery
 - 5. Management considerations
 - a. Airway and ventilation
 - (1) Suction

- (2) Positive pressure ventilation with 100% oxygen
 - (3) Endotracheal intubation
 - b. Circulation
 - (1) Heart rate less than 100
 - (a) BVM ventilation with 100% oxygen and reassess
 - (2) Heart rate less than 60
 - (a) Begin chest compressions
 - (3) Heart rate between 60 and 80 but not responding to assisted ventilations with BVM
 - (a) Begin chest compressions
 - (4) Discontinue chest compressions when heart rate reaches 100
 - c. Pharmacological
 - (1) Epinephrine
 - d. Non-pharmacological
 - (1) Maintain temperature
 - e. Transport consideration
 - (1) Identify facility to handle high-risk newborn
 - f. Psychological support/ communication strategies
 - (1) Explain what is being done for the infant
- E. Premature infants
- 1. Epidemiology
 - a. Incidence
 - (1) Born prior to 37 weeks gestation
 - (2) Weight ranges from .6-2.2 kg
 - b. Morbidity/ mortality
 - (1) Healthy premature infants weighing greater than 1700 g have a survivability and outcome approximately that of full-term infants
 - (2) Respiratory suppression
 - (3) Hypothermia risk
 - (4) Head/ brain injury
 - (a) Hypoxemia
 - (b) Change in blood pressure
 - (c) Intraventricular hemorrhage
 - (d) Fluctuations in serum osmolarity
 - c. Risk factors
 - (1) Mortality decreases weekly with gestation beyond the onset of viability (currently around 23-24 weeks of gestation)
 - 2. Anatomy and physiology review
 - 3. Pathophysiology
 - a. Retinopathy of prematurity
 - (1) Result of long term oxygen use
 - (2) Extreme prematurity
 - (3) Should not be a factor in short term management
 - (4) Hypoxemia causes irreparable brain damage
 - 4. Assessment findings
 - a. Degree of immaturity determines the physical characteristics
 - b. Generally a large trunk and short extremities
 - c. Skin is transparent and less wrinkles

- d. Less subcutaneous fat
- 5. Management considerations
 - a. Attempt resuscitation if the infant has any sign of life
 - b. Airway and ventilation
 - (1) Suction
 - (2) Assure adequate oxygenation
 - c. Circulation
 - (1) Chest compressions if indicated
 - d. Pharmacological
 - (1) Epinephrine
 - e. Non-pharmacological
 - (1) Maintain body temperature
 - f. Transport consideration
 - (1) Transport to a facility with special services for low birth weight newborns
 - g. Psychological support/ communication strategies
 - (1) Explain what is being done for the infant
- F. Respiratory distress/ cyanosis in the neonate
 - 1. Epidemiology
 - a. Incidence
 - (1) Prematurity is the single most common factor
 - (2) Occurs most frequently in infants less than 1200 grams and 30 weeks gestation
 - (3) Multiple gestations increase risk
 - (4) Prenatal maternal complications increase risk
 - b. Morbidity/ mortality
 - (1) Premature infants have a immature central respiratory control center
 - (2) Easily affected by environmental or metabolic changes
 - c. Risk factors
 - (1) Associated respiratory diseases/ complications affect oxygenation
 - 2. Anatomy and physiology review
 - 3. Pathophysiology
 - a. Lung or heart disease
 - b. Primary pulmonary hypertension
 - c. CNS disorders
 - d. Mucous obstruction of nasal passages
 - e. Spontaneous pneumothorax
 - f. Choanal atresia
 - g. Meconium aspiration
 - h. Amniotic fluid aspiration
 - i. Lung immaturity
 - j. Pneumonia
 - k. Shock and sepsis
 - l. Metabolic acidosis
 - m. Diaphragmatic hernia
 - n. Can lead to cardiac arrest
 - 4. Assessment findings
 - a. Tachypnea
 - b. Paradoxical breathing

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- c. Periodic breathing
 - d. Intercostal retractions
 - e. Nasal flaring
 - f. Expiratory grunt
 - 5. Management considerations
 - a. Airway and ventilation
 - (1) Suction
 - (2) High concentration oxygen
 - (3) BVM
 - (4) Consider intubation
 - b. Circulation
 - (1) Chest compressions if indicated
 - c. Pharmacological
 - (1) Sodium bicarbonate may be helpful for prolonged resuscitation per medical direction
 - (2) D10 administration if hypoglycemic
 - d. Non-pharmacological
 - (1) Maintain normal body temperature
 - e. Transport consideration
 - f. Psychological support/ communication strategies
 - (1) Explain what is being done for the infant
 - G. Seizures in the neonate
 - 1. Epidemiology
 - a. Incidence
 - (1) Occur in a very small percentage of all newborns
 - b. Morbidity/ mortality
 - (1) Represent relative medical emergencies as they are usually a sign of an underlying abnormality
 - c. Risk factors
 - (1) Prolonged and frequent multiple seizures may result in metabolic changes and cardiopulmonary difficulties
 - 2. Anatomy and physiology review
 - 3. Pathophysiology
 - a. Types of seizures
 - (1) Subtle seizure
 - (a) Eye deviation, blinking, sucking, swimming movements of the arms, pedaling movements of the legs, apnea
 - (2) Tonic seizure
 - (a) Tonic extension of the limbs
 - (b) Less commonly, flexion of the upper extremities and extension of the lower extremities
 - (c) More common in premature infants, especially in those with intraventricular hemorrhage
 - (3) Multi focal seizure
 - (a) Clonic activity in one extremity
 - (b) Randomly migrates to another area of the body
 - (c) Occur primarily in full-term infants
 - (4) Focal clonic seizure

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- (a) Clonic localized jerking
 - (b) Occur in both full-term and premature infants
 - (5) Myoclonic seizure
 - (a) Flexion jerks of the upper or lower extremities
 - (b) May occur singly or in a series of repetitive jerks
 - b. Causes
 - (1) Hypoglycemia
 - (2) Other
 - (a) Hypoxic-ischemic encephalopathy
 - (b) Intracranial hemorrhage
 - (c) Metabolic disturbances
 - (d) Meningitis or encephalopathy
 - (e) Developmental abnormalities
 - (f) Drug withdrawal
 - 4. Assessment findings
 - a. Decreased level of consciousness
 - b. Seizure activity
 - 5. Management considerations
 - a. Airway and ventilation
 - (1) Maintain oxygen saturation
 - b. Circulation
 - c. Pharmacological
 - (1) Consider D₁₀ for hypoglycemia
 - (2) Consider anticonvulsant
 - (3) Consider benzodiazepine for status epilepticus
 - d. Non-pharmacological
 - (1) Maintain normal body temperature
 - e. Transport consideration
 - (1) Identify facility to handle high-risk newborn
 - f. Psychological support/ communication strategies
 - (1) Explain what is being done for the infant
- H. Fever in the neonate
 - 1. Epidemiology
 - a. Incidence
 - (1) Rectal temperature \geq 100.4 F (38.0 degrees C)
 - (2) Average normal temperature - 99.5 degrees F (37.5 degrees C)
 - b. Morbidity/ mortality
 - (1) Limited ability to control body temperature
 - c. Risk factors
 - (1) Dehydration may contribute to hyperthermia
 - 2. Anatomy and physiology review
 - 3. Pathophysiology
 - a. Increased use of glucose to maintain normal body temperature
 - b. Anaerobic metabolism results due to a lack of glucose
 - 4. Assessment findings
 - a. Mental status changes (irritability/ somnolence)
 - b. Decreased intake
 - c. Caretaker history

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- d. Feels warm
 - e. Observe patient for rashes, petechia
 - f. Term newborns will produce beads of sweat on their brow but not over the rest of their body
 - g. Premature infants will have no visible sweat
 - 5. Management considerations
 - a. Airway and ventilation
 - (1) Assure adequate oxygenation and ventilation
 - b. Circulation
 - (1) Perform chest compressions if indicated
 - c. Pharmacological
 - (1) Administration of antipyretic agent is questionable in the prehospital setting
 - d. Non-pharmacological
 - e. Transport consideration
 - f. Psychological support/ communication strategies
 - (1) Explain what is being done for the infant
 - I. Hypothermia in the neonate
 - 1. Epidemiology
 - a. Incidence
 - (1) Body temperature drops below 35 degrees C
 - b. Morbidity/ mortality
 - (1) Infants may die of cold exposure at temperatures adults find comfortable
 - c. Risk factors
 - (1) Four method of heat loss need to be controlled
 - (a) Evaporation
 - (b) Conduction
 - (c) Convection
 - (d) Radiation
 - 2. Anatomy and physiology review
 - 3. Pathophysiology
 - a. Increased surface-to-volume relation makes newborns extremely sensitive to environmental conditions, especially when they are wet after delivery
 - b. Can be an indicator of sepsis in the neonate
 - c. Increased metabolic demand can cause metabolic acidosis, pulmonary hypertension and hypoxemia
 - 4. Assessment findings
 - a. Pale color
 - b. Cool to touch, particular in extremities
 - c. Acrocyanosis
 - d. Respiratory distress
 - e. Apnea
 - f. Bradycardia
 - g. Central cyanosis
 - h. Irritability initially
 - i. Lethargy in late stage
 - j. Generally do not shiver
 - 5. Management considerations

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- a. Airway and ventilation
 - (1) Assure adequate oxygenation and ventilation
 - b. Circulation
 - (1) Perform chest compressions if indicated
 - c. Pharmacological
 - (1) D10 if hypoglycemic
 - (2) Warm IV fluids
 - d. Non-pharmacological
 - (1) Environmental conditions should be 24 to 26.5 degrees C
 - (2) Warm hands prior to touching patient
 - e. Transport consideration
 - (1) Identify facility to handle high-risk newborn
 - f. Psychological support/ communication strategies
 - (1) Explain what is being done for the infant
- J. Hypoglycemia in the neonate
- 1. Epidemiology
 - a. Incidence
 - (1) Blood glucose concentration should be determined on all sick infants
 - (2) May be due to inadequate glucose intake or increased utilization of glucose
 - b. Morbidity/ mortality
 - (1) Persistent low blood glucose levels may have catastrophic effects on the brain
 - c. Risk factors
 - (1) Asphyxia, toxemia, smaller twin, CNS hemorrhage, sepsis
 - 2. Anatomy and physiology review
 - 3. Pathophysiology
 - a. A blood glucose screening test less than 45 mg/dl indicates hypoglycemia
 - b. Glycogen stores are sufficient to meet glucose requirements for 8 to 12 hours
 - c. Body releases counter-regulatory hormones including Glucagon, epinephrine, cortisol and growth hormone
 - d. Hormones may cause symptoms of hyperglycemia that last for several hours
 - 4. Assessment findings
 - a. Twitching or seizures, limpness, lethargy, eye-rolling, high pitched cry, apnea, irregular respirations and possible cyanosis
 - 5. Management considerations
 - a. Airway and ventilation
 - (1) Assure adequate oxygenation and ventilation
 - b. Circulation
 - (1) Perform chest compressions if indicated
 - c. Pharmacological
 - (1) Administer D10
 - d. Non-pharmacological
 - (1) Maintain normal body temperature
 - e. Transport consideration
 - (1) Identify facility to handle high-risk newborn
 - f. Psychological support/ communication strategies
 - (1) Explain what is being done for the infant

- K. Vomiting in the neonate
 - 1. Epidemiology
 - a. Incidence
 - (1) Persistent vomiting is a warning sign
 - (2) Vomiting mucous, occasionally blood streaked, in the first few hours of life is not uncommon
 - b. Morbidity/ mortality
 - (1) Vomiting in the first 24 hours of life suggests obstruction in the upper digestive tract or increased intracranial pressure
 - (2) Vomitus containing dark blood is usually a sign of a life-threatening illness
 - c. Risk factors
 - (1) Aspiration of vomitus can cause respiratory insufficiencies or obstruction of the airway
 - 2. Anatomy and physiology review
 - 3. Pathophysiology
 - a. Vomiting of non-bile-stained fluid
 - (1) Anatomic or functional obstruction at or above the first portion of the duodenum
 - (2) Gastroesophageal reflux
 - b. Vomiting of bile-stained fluid
 - (1) Obstruction below the opening of the bile duct
 - 4. Assessment findings
 - a. Distended stomach
 - b. Infection
 - c. Increased ICP
 - d. Drug withdrawal
 - 5. Management considerations
 - a. Airway and ventilation
 - (1) Maintain a patent airway
 - (2) Suction/ clear vomitus from airway
 - (3) Assure adequate oxygenation
 - b. Circulation
 - (1) Bradycardia may be caused by vagal stimulus
 - c. Pharmacological
 - (1) Fluid administration may be required
 - d. Non-pharmacological
 - (1) Provide supportive measures
 - e. Transport consideration
 - (1) Place infant on side
 - (2) Identify facility to handle high-risk newborn
 - 6. Psychological support/ communication strategies
 - a. Explain what is being done for the infant
- L. Diarrhea in the neonate
 - 1. Epidemiology
 - a. Incidence
 - (1) Normal - five to six stools per day, especially if breast feeding
 - b. Morbidity/ mortality

- (1) Severe cases can cause dehydration
 - (2) Bacterial or viral infection may be involved
 - c. Risk factors
 - (1) Severe loss can cause electrolyte imbalance
 - 2. Anatomy and physiology review
 - 3. Pathophysiology
 - a. Gastroenteritis
 - b. Lactose intolerance
 - c. Phototherapy
 - d. Neonatal abstinence syndrome
 - e. Thyrotoxicosis
 - f. Cystic fibrosis
 - 4. Assessment findings
 - a. Loose stools
 - b. Decreased urinary output
 - c. Signs of dehydration
 - 5. Management considerations
 - a. Airway and ventilation
 - (1) Assure adequate oxygenation
 - b. Circulation
 - (1) Perform chest compressions if indicated
 - c. Pharmacological
 - (1) Fluid therapy may be indicated
 - d. Non-pharmacological
 - (1) BSI procedures
 - e. Transport consideration
 - (1) Identify facility to handle high-risk newborn
 - f. Psychological support/ communication strategies
 - (1) Explain what is being done for the infant
- M. Common birth injuries in the newborn
 - 1. Epidemiology
 - a. Incidence
 - (1) Used to denote avoidable and unavoidable mechanical and anoxic trauma incurred by the infant during labor and delivery
 - (2) Estimated to occur in 2 to 7 of every 1,000 live births
 - b. Morbidity/ mortality
 - (1) 5 to 8 of every 100,000 infants die of birth trauma
 - (2) 25 of every 100,000 die of anoxic injuries
 - (3) Such injuries account for 2 - 3% of infant deaths
 - c. Risk factors
 - (1) Explosive delivery
 - 2. Anatomy and physiology review
 - 3. Pathophysiology
 - a. Cranial injuries
 - (1) Molding of the head and overriding of the parietal bones
 - (2) Erythema, abrasions, ecchymosis and subcutaneous fat necrosis can occur with forceps delivery

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- (3) Subconjunctival and retinal hemorrhage
 - (4) Subperiosteal hemorrhage
 - (5) Fracture of the skull
 - b. Intracranial hemorrhage
 - (1) May result from trauma or asphyxia
 - c. Spine and spinal cord
 - (1) Strong traction exerted when the spine is hyperextended or pull is lateral
 - d. Peripheral nerve injury
 - e. Liver
 - f. Rupture of the spleen
 - g. Adrenal hemorrhage
 - h. Fracture
 - (1) Clavicle
 - (2) Extremities
 - i. Hypoxia-ischemia
 - 4. Assessment findings
 - a. Diffuse, sometimes ecchymotic, edematous swelling of the soft tissues of the scalp
 - b. Paralysis below the level of spinal cord injury
 - c. Paralysis of the upper arm with or without paralysis of the forearm
 - d. Diaphragmatic paralysis
 - e. Movement on only one side of the face when the newborn cries
 - f. Does not move arm freely on side of fractured clavicle
 - g. Lack of spontaneous movement of the affected extremity
 - h. Hypoxia
 - i. Shock
 - 5. Management considerations
 - a. Airway and ventilation
 - (1) Assure adequate oxygenation and ventilation
 - b. Circulation
 - (1) Perform chest compressions if indicated
 - c. Pharmacology
 - (1) Provide if indicated
 - d. Non-pharmacological
 - (1) Provide supportive measures
 - e. Transport consideration
 - (1) Identify facility to handle high-risk newborn
 - f. Psychological support/ communication strategies
 - (1) Explain what is being done for the newborn
- IV. Neonatal resuscitation and post resuscitation and stabilization
 - A. Neonatal cardiac arrest management
 - 1. Epidemiology
 - a. Incidence
 - (1) Primarily related to hypoxia
 - b. Morbidity/ mortality
 - (1) Outcome is poor if interventions are not initiated quickly
 - (2) Increased likelihood of brain and organ damage
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- c. Risk factors
 - (1) Intrauterine asphyxia
 - (2) Prematurity
 - (3) Drugs administered to or taken by the mother
 - (4) Congenital neuromuscular diseases
 - (5) Congenital malformations
 - (6) Intrapartum hypoxemia
 - 2. Anatomy and physiology review
 - 3. Pathophysiology
 - a. Primary apnea
 - b. Secondary apnea
 - c. Bradycardia
 - d. Persistent fetal circulation
 - e. Pulmonary hypertension
 - 4. Assessment findings
 - a. Peripheral cyanosis
 - b. Inadequate respiratory effort
 - c. Ineffective or absent heart rate
 - 5. Management considerations
 - a. Airway and ventilation
 - (1) Assure adequate oxygenation and ventilation
 - (a) Blow-by oxygenation is required if peripheral cyanosis is present and despite adequate respiratory effort and heart rate greater than 100 beats/ min
 - (b) Ventilations are required if respiratory effort is inadequate, ineffective or absent or heart rate is less than 80 beats/ min
 - (c) Ventilate at a rate of 40 to 60 breaths per minute
 - (d) Administer a tidal volume sufficient to expand the chest
 - (e) Intubation required if bag-valve-mask ventilations are ineffective, tracheal suctioning is required or prolonged positive-pressure ventilation is necessary
 - b. Chest compressions are indicated if pulse is less than 60 beats/ minute, or between 60 and 80 beats/ minute and not improving despite assisted ventilations with BVM
 - (1) Suction airway thoroughly
 - c. Circulation
 - (1) Perform chest compression
 - d. Pharmacological
 - (1) Epinephrine
 - (2) Normal saline or Ringer's lactate
 - (3) Sodium bicarbonate
 - (4) Naloxone
 - (5) Dextrose (D10)
 - e. Non-pharmacological
 - (1) Maintain normal body temperature
 - f. Transport consideration
 - (1) Identify facility to handle high-risk newborn
 - g. Psychological support/ communication strategies

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